

REMARKS

This is in response to the non-final Official Action currently outstanding with respect to the above-identified application.

Claims 10 and 12 are pending in the above-identified application. Claims 1-9, 11, and 13-20 previously were withdrawn from further consideration in the above-identified application as being directed to non-elected subject matter. Claim 10 is amended. No additional claims are added, cancelled or withdrawn. Accordingly, upon the entry of the foregoing Amendment, Claims 10 and 12 as hereinabove amended will constitute the claims currently under active prosecution in the above-identified application.

The claims of the above-identified application as they currently stand are reproduced above including appropriate status indicators and indications of the changes being made as required by the Rules.

More particularly, in the currently outstanding non-final Official Action the Examiner has:

- 1) Not re-acknowledged Applicants' claim for foreign priority under 35 USC §119 (a)-(d) or (f), and reconfirmed the receipt by the United States Patent and Trademark Office of the required copies of the priority documents. – **Applicants respectfully note that this issue was satisfactorily handled by the Examiner in a previous Official Action in this prosecution.**
- 2) Not reconfirmed his acceptance of the formal drawings filed in the above-identified application on 8 February 2006. - **Applicants respectfully note that this issue was satisfactorily handled by the Examiner in a previous Official Action in this prosecution.**

- 3) Again inquired as to whether all of the inventions of all of the pending claims were commonly owned at the time that they were made. – **In response, Applicants again respectfully confirm that the subject matter of all of the claims of this application was commonly owned at the time that it was made**
- 4) Indicated that Applicants' previous argument concerning Claims 10 and 12 is deemed to be moot in view of his new grounds for rejection.
- 5) Rejected Claims 10 and 12 under 35 USC 103(a) as being unpatentable over Kato et al (JP 2002-172786) in view of Nou (US Published Patent Application No. 2003/0025744) and/or Yamada (US Published Patent Application No. 2003/0085940) or alternatively over Hotomi (US Patent No. 5,477,249) and/or Grimes (US Published Patent Application No. 2002/0005876) and/or Hertz (US Patent 4,196,437) and Nou (US Published Patent Application No. 2003/0025744) and/or Mantelli (US Patent No. 6,264,298) and/or Yamada (US Published Patent Application No. 2003/0085940).

Further comment concerning items 1-4 above is not deemed to be required in these Remarks.

With respect to item 5, on the other hand, Applicants respectfully note that the foregoing Amendment is supported in the specification of the above-identified application as originally filed at least at Page 84, line 16 to Page 87, line 6.

Furthermore, Applicants respectfully submit that in the present invention, the fluid discharge hole of the nozzle is designed to have a miniaturized diameter ranging from 0.01 μ m to 15 μ m, so that a local field is generated. This miniaturization of the nozzle allows a reduction in a required drive voltage for discharge.

Hence, if the condition to cause discharge is met by a local field strength, the upper limit of the nozzle diameter is preferably 15 μm . This allows the nozzle of the discharge head to discharge a fluid by electronic suction, not by a piezo element and/or a thermal element as are employed in conventional inkjet printers.

However, in the structure referred to above (wherein the fluid discharge hole of the nozzle is designed to have a miniaturized diameter ranging from 0.01 μm to 15 μm), the discharge response basically depends upon the electrical resistance of fluid (discharge material) between the electrode in the nozzle and the tip of the nozzle. Therefore, the discharge response may be extremely changed by a change in electrical conductivity of the fluid. In such a case, it may not be possible to perform stable in-line drawing depending upon the relative speed between the nozzle and the substrate (this problem being hereinafter sometimes referred to as "problem A" for convenience of reference).

Problem A arises from the miniaturization of the tip of the nozzle which results in (1) an increase in electrical resistance that leads to a deterioration in the discharge response, and (2) super-miniaturization of the diameter/width of the dot/line that is formed on the substrate. It will be understood that this is a new problem that was not an issue in connection with conventional discharge amounts.

In order to deal with the new problem A, the present invention employs a structure X for controlling a speed of the relative movement such that adjacent ones of the discharge patterns are partly overlaid with one another in accordance with a period of intermittent discharge that is performed when applying a direct current bias voltage equal to or greater than the minimum voltage required to induce discharge, and which is performed at a frequency depending upon the direct current bias voltage and an electrical conductivity of the fluid. The Applicants have found that the structure X can solve the problem A (the problem that stable line-drawing cannot be performed due to the miniaturization of the fluid discharge hole of the nozzle to a range between 0.01 μm to 15 μm).

In contrast to the foregoing, the Hotomi reference discloses an ink discharge device for discharging an ink from a nozzle utilizing both electrostatic suction and the vibration of piezoelectric elements. Applicants respectfully submit that the latter assertion is clear from the descriptions found in the Hotomi reference at Column 4, lines 44-55, Column 9, lines 16-21 and Column 10, lines 30-37.

Accordingly, Applicants respectfully submit that since the ink discharge device of the Hotomi reference uses not only electrostatic suction but also the vibration of piezoelectric elements, the Hotomi reference does not deal with the problem A discussed above which is unique to the structure in which the nozzle diameter in miniaturized and fluid is discharged only by electrostatic suction.

In addition, Applicants respectfully submit that the Nou, Mantell and Yamada references, which allegedly disclose a fluid discharge device controlling the relative movement so that adjacent ones of the discharge patterns are partially overlaid with each other, in fact only disclose the partial overlaying of dots (discharge patterns) formed by applying pulsed voltages.

Accordingly, it appears to be clear that a combination of the Hotomi reference with the Nou reference, the Mantell reference or the Yamada reference would have reached a structure for discharging fluid by electrostatic suction and vibration of piezoelectric elements wherein when ink density was low or dot size was small, for example, dots discharged by the application of a pulsed voltage are partially overlaid relative to each other. Applicants respectfully submit that such a combination is entirely different from that of the structure X of the present invention.

The nozzle diameter of the Kato reference, on the other hand, partially overlaps the nozzle diameter of the present invention in the range between 5 to 15 μm . Hence, there is a possibility that the Kato reference could deal with the problem A discussed above.

However, it will be understood that the Kato reference does not provide any test results using the foregoing miniaturized nozzle diameter. Consequently, Applicants respectfully submit that the Kato reference is insufficient to disclose that dot-like discharge patterns are formed by intermittent discharge in spite of the application of a direct current bias voltage.

Therefore, Applicants believe that it is apparent that a combination of the Kato reference with the Nou reference, the Mantell reference or the Yamada reference would have reached a structure wherein a fluid is discharged by electrostatic suction when ink density is low or dot size is small, for example, dots discharged by the application of a pulsed voltage are partially overlaid. Again, the structure disclosed, taught or suggested by the cited art is entirely different from the structure X of the present invention.

In summary, therefore, Applicants respectfully submit that it will be understood that the Hotomi reference, the Kato reference, the Nou reference, the Mantell reference and the Yamada reference whether taken alone or in combination with one another do not deal with the problem A discussed above with which the present invention deals, that is the problem raised by the miniaturization of the tip of the nozzle that results in (1) an increase in electrical resistance that leads to deterioration in the nozzle discharge response, and (2) super-miniaturization of the diameter/width of the dot/line that is formed on the substrate. Furthermore, the cited and relied upon references do not teach, disclose or suggested either alone or in combination the structure X of the present invention that the Applicants have discovered for the purpose of solving the problem A.

Therefore, Applicants respectfully submit that Claims 10 and 12 of the above-identified application as hereinabove amended are neither disclosed, nor taught, nor suggested by any of the currently cited and relied upon art, whether the same is taken alone or in combination. Accordingly entry of the foregoing Amendment, and reconsideration an allowance of the so amended Claims in view of the foregoing Remarks in response to this submission are respectfully requested.

Applicants also believe that additional fees beyond those submitted herewith are not required in connection with the consideration of this Amendment. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge and/or credit Deposit Account No. **04-1105**, as necessary, for the correct payment of all fees which may be due in connection with the filing and consideration of this communication.

Respectfully submitted,

Date: November 21, 2011

By: /David A. Tucker/
Electronic Signature of Practitioner
David A. Tucker
(Reg. No. 27,840)
Edwards Wildman Palmer LLP
P.O. Box 55874
Boston, MA 02205

Phone: (617) 517-5508

Customer No. 21874